Description of *Gracilacus yokooi* n. sp. (Tylenchida: Paratylenchidae) from Mulberry Roots in Japan with Some Observation on its Ecology

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Gracilacus yokooi n. sp., which was found in the soil around mulberry roots is described and some observations on its ecology are presented. This species resembles *G. acicula*, which has been reported by YOKOO (1970) as *Paratylenchus aciculus* BROWN, 1959. It differs from *G. acicula* in having four lateral lines, swollen females, a more posterior location of the excretory pore, and relatively commonly occurring males. It is also closely related to *G. ivorensis* (LUC et DE GUIRAN), *G. crenata* CORBETT, and *G. straeleni* (DE CONINK), but can be distinguished from the first species by its longer spear and slender conoid tail shape which relatively invariant, from the second species by its shorter spear and more anterior vulva, and from the last species by its more posteriorly located vulva and smaller b-value. This species is parasitic on mulberry, and is distributed in Shikoku, Kyushu, and the southern half of Honshu. Populations of *G. yokooi* emerged in the soil in the middle spring, increased in the summer reaching a maximum in August, and then decreased in the fall. They were hardly found during the winter. The highest density of *G. yokooi* was detected in soil around mulberry roots 50cm deep. The second highest was at 80cm deep. *Jpn. J. Nematol.* **12**: 15-20 (1983)

Soils were collected from mulberry fields in Japan to examine nematode species. A pin nematode with a long flexible spear was found from these samples, and this appeared to resemble the one reported by YOKOO[6] as *Paratylenchus aciculus* BROWN, 1959 from soil around mulberry roots at Kumamoto Prefecture. The authors obtained soil samples from the same locality where Yokoo had collected *P. aciculus*, and compared morphology of nematode specimens with the results of his observation (Table 1.), and concluded that this species was not *P. aciculus* because of having four lateral lines and other characteristics, but to be a new species which was described as *Gracilacus yokooi* n. sp. herein.

Gracilacus yokooi n. sp.

(Fig. 1. A-G)

Description and measurements

Swollen female (n=13): L=360μm(260-400), a=11(8-13), b=4.6(4.1-5.2), c=14(11-18), V=79(78-82), spear=54μm(54-56), stylet cone=47μm(46-48), excretory pore to anterior end=37μm (32-40).

Slender female (n=15): L=320μm(290-350), a=24(22-25), b=2.9(2.7-3.9), c=13(12-13), V=77(71-78), spear=63μm(60-65), stylet cone=53μm(50-56), excretory pore to anterior end=85μm(80-97). Holotype: L=320μm, a=23, b=2.8, c=13, V=76, spear=65μm, stylet cone=56 μm, excretory pore to anterior end=86μm. Body slender, curved ventrally in a slightly open "C" shape when killed by gentle heat. Head truncated with indistinct set-off lips. Spear long, slender, flexible, slightly curved ventrally. Knobs of spear small, backwardly directed. Dorsal esophageal gland oriffice open 3-5μm behind spear base. Excretory pore located on ventral side near nerve ring. Lateral field with obscure, four incisures, outer two lighter than inner two.

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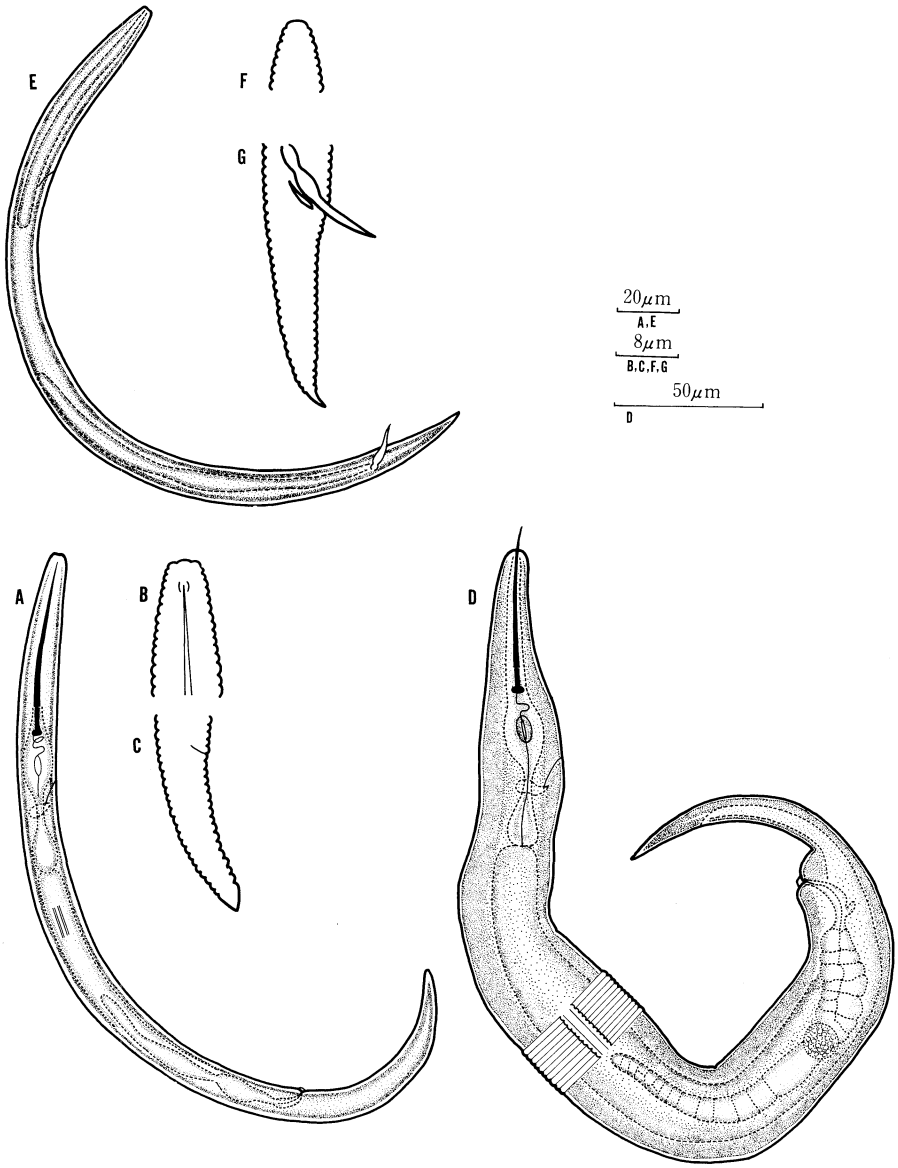

Fig. 1. *Gracilacus yokooi* n. sp.
Slender female, A: Entire body, B: Head region, C: Tail. D: Swollen female entire body. Male, E: Entire body, F: Head region, G: Tail.

Vulva with small lateral membrane. Tail slender-conoid, ending subacute terminus. Slender females become swollen about three times body width, and found not only in soil but inside root tissues.

Male (n=10): L=320μm(280-340), a=30(28-32), b=3.2(3.0-3.3), c=13(12-15), spicules=16μm (15-17), gubernaculum=5μm (5-6), excretory pore to anterior end=72μm (60-79). Allotype: L=330μm, b=3.2, c=14, spicules=16μm, gubernaculum=5μm, excretory pore to

anterior end=74μm. Distinct sexual dimorphism observed. Body slender, spear lacking.

Type specimens

Holotype: Female on slide no. 76/9/1, deposited in the Laboratory of Entomology of Sericultural Experiment Station, Yatabe, Tsukuba, Ibaraki, Japan. Paratypes: Slide nos. 76/9/2-76/9/10, deposited as above. Allotype: Male on slide no. 76/9/11, deposited as above.

Type host: Mulberry, *Morus alba* LINNE.

Type locality: Wada, Suginami, Tokyo, Japan.

Table 1. Comparison of *Gracilacus yokooi* n. sp. with Yokoo's description.

	Authors (Kumamoto)		Yokoo, 1970 (Kumamoto)	
n	20♀♀	21♂♂	7♀♀	5♂♂
L (μm)	300 (270 -280)	290 (240 -340)	330 (260 -390)	293 (270 -345)
a	26 (22 - 29)	28 (23 - 31)	21.3(18.4- 23.6)	25.5(21.6- 28.5)
b	2.7(2.5- 3.0)	3.4(3.0- 3.7)	2.6(2.4- 2.7)	3.7(3.6- 4.1)
c	12 (10 - 14)	11 (10 - 13)	12.0(10.0- 15.9)	12.0(10.8- 13.1)
V	77 (73 - 78)	—	70.0(68.3- 73.5)	—
Spear (μm)	61 (54 - 66)	—	62.3(60.4- 65.0)	—
Stylet cone (μm)	52 (44 - 57)	—	?	—
Excretory pore to anterior end (μm)	81 (70 - 91)	71 (57 - 80)	?	?
Dorsal esophageal gland oriffice to spear base (μm)	4.5(3.5- 5.0)	—	4.0	—
Spicules (μm)	—	16 (15 - 18)	—	15.0
Gubernaculum (μm)	—	5 (4 - 6)	—	6.0
Lateral incisures	4	4	3	?

Diagnosis

Gracilacus yokooi n. sp. differs from *G. acicula* (BROWN, 1959) RASKI, 1962[4] (*Paratylenchus aciculus* BROWN, 1959) in four lateral lines (three in *P. aciculus*), swollen female with lateral vulval membrane, the more posterior location of excretory pore (opening on ventral side near nerve ring in *G. yokooi* but near stylet knobs in *G. acicula*), and not so rare occurrence of male.

This species closely related to *G. ivorensis* (LUC et DE GUIRAN, 1962) RASKI, 1976[3], *G. crenata* CORBETT, 1966[2] and *G. straeleni* (DE CONINCK, 1931) RASKI, 1976[1,5], but can be distinguished from the first species by the larger spear (60-65μm *vs.* 52-59μm of *G. ivorensis*) and slender conoid tail which has hardly variation of shape, from the second species by shorter spear (61-73μm in *G. crenata*) and the more anterior location of vulva (V=73-78 *vs.* 76-81 of *G. crenata*), and from the last species by the more anteriorly located vulva (V=79-83 in *G. straeleni*) and smaller b-value (2.7-3.0 *vs.* 3.1-4.4 of *G. straeleni*).

Ecology

Parasitism to mulberry : *G. yokooi* was evidently parasitic to mulberry, and this was proved by pot tests. No other hosts are known so far.

Geographical distribution: *G. yokooi* was found at mulberry fields in the following region of Japan; Yamagata, Niigata, Nagano, Ibaraki, Tochigi, Gunma, Yamanashi, Tokyo, Gifu, Aichi, Fukui, Kyoto, Mie, Hyogo, Kochi, Saga, Kumamoto, Nagasaki and Kagoshima. It is so far known that this nematode appears to distribute in mainly southern half of Honshu (mainland), Shikoku, and Kyushu.

Vertical distribution (Fig. 2): To examine vertical distribution of this nematode in a mulberry field at Sekijo, Ibaraki, soil blocks (10×20×10cm) were colleced from every 10cm depth up to 100cm deep, twice of late April and middle May, and then mulberry rootlets were collected from them and nematodes separated from 100g soil out of mixed 2 litres. The data showed in Fig. 2

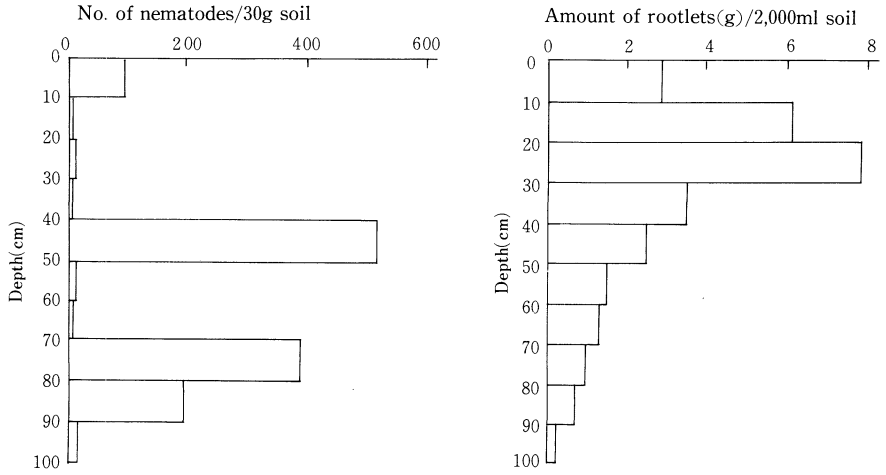

Fig. 2. Vertical distribution of female of *Gracilacus yokooi* and mulberry rootlets in the soil of a mulberry field in spring of 1980.

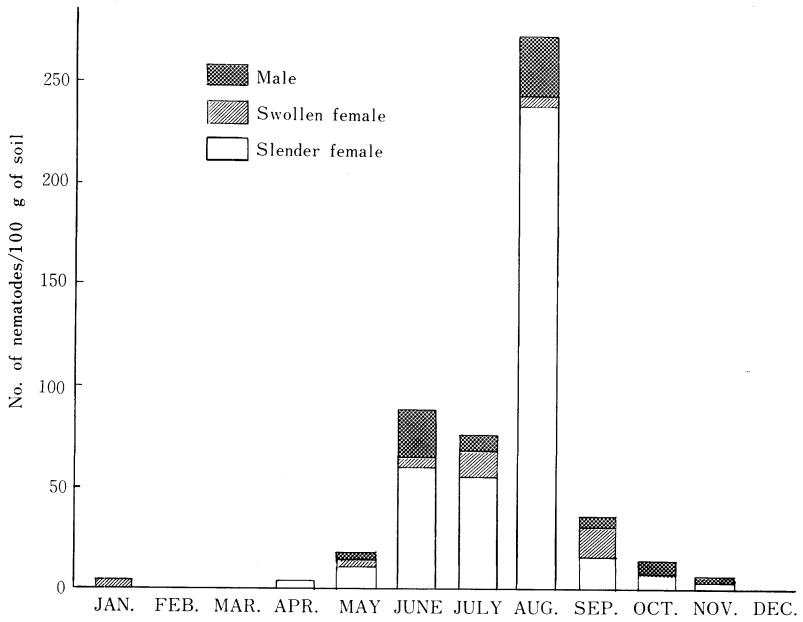

Fig. 3. Seasonal prevalence of *Gracilacus yokooi* in a mulberry field in 1978 and 1979.

is the mean of two replicates.

The largest number of females of *G. yokooi* was found in the soil at a depth of 50cm, which was followed by 80-90cm depth and 10cm depth. The largest amount of mulberry rootlets was observed at a depth of 30cm, which was followed by 20cm depth and 10cm or 40cm depth. Amount of collected rootlets remarkably decreased at deeper than 50cm.

Seasonal prevalence (Fig. 3): Seasonal prevalence of *G. yokooi* was observed in 1978 and 1979 in 10-year-old-mulberry field about 5 ares in extent located at Suginami, Tokyo, where soil samples were taken from nine spots in a field once a month. Nematodes were separated from 100g of mixed soil by sieving-centrifugal floatation method with 100 and 400 mesh screen. Slender females, swollen females and males of *G. yokooi* were counted under microscope.

Slender females appeared first in the soil in April and increased its number rapidly toward summer reaching maximum in August, and then remarkably decreased toward winter. Swollen females in the soil were first found in May and increased in July. They decreased slightly in August and increased again in September but none of them was found from October to December. Some number of swollen females were observed in January. Males first appeared also in May and increased in June. They slightly decreased in July but increased again in August and subsequently decreased. From these results, the population of *G. yokooi* in a mulberry field first emerged in the soil in middle spring, increased in summer reaching maximum in August, and then decreased rapidly in fall with the fact that nematodes were hardly found from winter to early spring. While, YOKOO[7] reported that the population of this nematode from Kyushu in mulberry field (he considered it as *Paratylenchus aciculus*) decreased to the lowest in mid-summer (July to August) and increased rapidly toward fall and winter, and these results were entirely different from what the authors observed.

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和 文 摘 要

クワのピンセンチュウの新種*Gracilacus yokooi*の記載と2，3の生態的知見

樋田幸夫・大島康臣・平田明由

東京都杉並区のクワ根辺土壌から採集したピンセンチュウを新種として記載し，あわせて，2，3の生態的知見を報告した。本種は横尾（1970）が*Paratylenchus aciculus*として報告した線虫と同一種であると考えられるが、側線が4本あること，雌は陰門部に薄い側膜を有し，体が肥大すること，排泄口がより後方に位置すること および雄の検出が それほどまれではないことなどから *Gracilacus acicula*（*P. aciculus*）とは明らかに異なる形態的特徴が認められた。本種は*G. ivorensis, G. crenata* および *G. straeleni*に類似するが，*G. ivorensis*とはより長い口針と変異の少ない円錐形の尾の形状によって，また*G. crenata*とはより短い口針とより後方に位置する陰門とによって，さらに*G. straeleni*とは陰門がより前方に位置することとb値がより小さいことでそれぞれ区別される。

本種にはクワへの寄生性が認められ，桑園土壌中では，雌成虫は深さ50cm前後にもっとも多く，ついで深さ80cm前後に多かった。本種の雌雄成虫は4月頃からみられ，8月にもっとも多く，9月以後減少し，冬期にはほとんどみられなくなった。本種はこれまで山形県以南の桑園から検出され，わが国の比較的温暖な地域に分布するようである。